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EMC 173

INSTRUCTION MANUAL
FOR
UHF IMPULSE GENERATOR
MODEL IG-115

MANUAL NO. 1-500783-182 (REV. A)

(For use with Model IG-115
Singer's Los Angeles Instrumentation Operation
Serial No. 101 and above)

This manual refers to Los Angeles Instrumentation Operation serial numbers 126 and above.

Appendix A, Manual Backdating Changes, at the rear of the manual, adapts this manual to serial numbers 101 thru 125.

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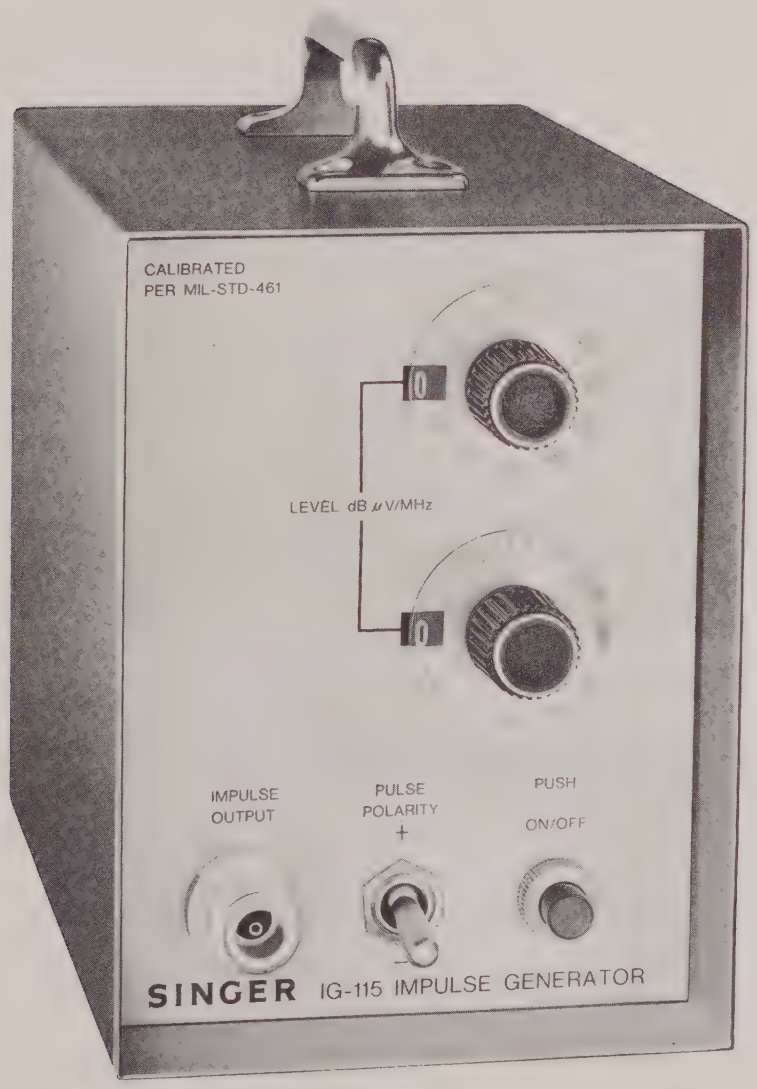


Figure 1-1. UHF Impulse Generator, Model IG-115

Section I

INTRODUCTION

1.1 SCOPE OF MANUAL

This manual provides operating and maintenance instructions for the Model IG-115 UHF Impulse Generator.

1.2 PURPOSE AND USE OF EQUIPMENT

The Model IG-115 UHF Impulse Generator is a broadband impulse generator (100 kHz to 1 GHz). It is an ideal unit for the following uses: rapid gain check for TV tuners (VHF and UHF), test for broadband electromagnetic interference (EMI) susceptibility of TV receivers, bandwidth determination, receiver alignment, measurements of RF intermodulation, transient response study, signal source for broadband distributed amplifiers, and signal source for evaluation of spectrum analyzers.

1.3 GENERAL DESCRIPTION

This instrument is a rugged combination of solid state components and vacuum tubes. It is designed to operate from either 115 Vac or 230 Vac, 50 Hz to 60 Hz power.

1.4 SUPPLIED ACCESSORIES

The items listed in Table 1-1 are furnished with the Model IG-115 Impulse Generator.

Table 1-1. Supplied Accessories

Quantity	Device	Singer Part No.
1	Instruction Manual	1-500783-182

1.5 OPTIONAL ACCESSORIES

Accessories available for use with the Model IG-115 follow.

a. RF Cable, Model 90933-6, 6 ft. with type N connectors.

b. 10 dB Attenuator, Model 90530-10, type N connectors,
Frequency response: dc to 1 GHz.
Accuracy: ±0.5 dB.
Voltage rating: Capable of accepting a pulse peak amplitude of 300 volts without voltage breakdown.

Section II

SPECIFICATIONS

2.1 INTRODUCTION

This section contains specification information for the Model IG-115.

2.2 SPECIFICATIONS

Table 2-1 contains the specification data for the Model IG-115 Impulse Generator.

Table 2-1. Specifications

Characteristics	Specification
Frequency range:	100 kHz to 1 GHz
Output level:* (Spectral Intensity)	0 dB μV/MHz to 100 dB μV/MHz (1 μV/MHz to 100,000 μV/MHz) Level is adjustable throughout a 100 dB range in 1 dB steps by means of two front panel step attenuators.
Level accuracy (100 kHz to 1 GHz):	±1 dB
Output load impedance:**	50 ohms. The load must provide a dc path to ground for proper operation.
Output receptacle:	Type N
Pulse Amplitude (max)	Approximately 280 V
Pulse width:	Approximately 0.5 nanoseconds
Pulse repetition rate:	50 or 60 pulses per second (same as input power line frequency)
Pulse polarity:	Reversible by a front panel toggle switch.

* See Paragraph 5.5 for explanation.
** See Paragraph 4.6.1 for explanation.

Table 2-1. Specifications, Continued

Characteristics	Specifications
Power requirements:	105 V to 130 V or 210 V to 260 V, 50 to 60 Hz, approximately 27 VA
Mechanical:	
Dimensions (including knobs and receptacles):	Approximate height: 15.2 cm (6") Approximate width: 11.4 cm (4.5") Approximate depth: 19.7 cm (7.7")
Weight:	Approximately 2.7 kg (6 lbs)
Environmental:	
Temperature	Operational: -15°C to +50°C (+5°F to +123°F) Non-operational: -50°C to +75°C (-58°F to +167°F)

Section III

INSTALLATION

3.1 INTRODUCTION

This section contains information for 115 V or 230 V operation.

3.2 PREPARATION FOR USE

3.2.1 Bench Operation

The Model IG-115 Impulse Generator is shipped ready for use as a bench-operated instrument.

3.2.2 115 V or 230 V Operation

The Model IG-115 Impulse Generator is supplied with a 3AG, 1/2A, normal blo fuse for 115 V operation. For 230 V operation, the fuse must be changed to 1/4 A and the transformer connections must be changed by reconnecting the jumpers on an internal terminal strip. See Figure 3-1 (Terminal Strip Connections) and refer to Paragraph 6-3 for case removal instructions.

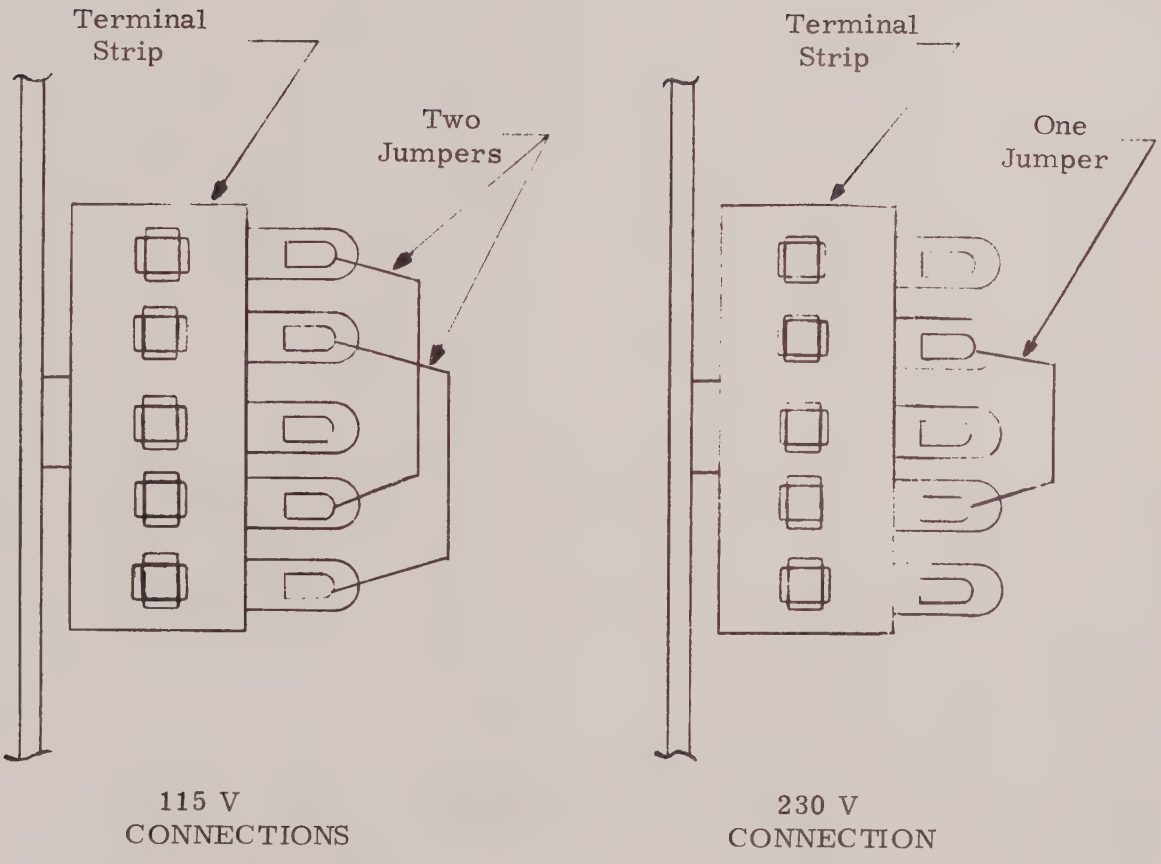


Figure 3-1. Terminal Strip Connections

Section IV

OPERATING INSTRUCTIONS

4.1 INTRODUCTION

This section deals with the functional description of controls, indicators and receptacles, operating instructions, and operating considerations.

4.2 OPERATING CONTROLS, INDICATORS AND RECEPTACLES

All external operating controls, indicators and receptacles of the Model IG-115 Impulse Generator are located on the front and back panels as indicated by Figure 4-1. Functions are described in Table 4-1 and items are located in Figure 4-1.

Table 4-1. Controls, Indicators and Receptacles

Item	Panel Marking	Description	Function
1	LEVEL dBuV/MHz	11 position rotary switch (S2)	Controls the output level of the IG-115 throughout a 90 dBμV/MHz range in 10 dB steps. Position between 90 and 0 disables the output.
2		11 position rotary switch (S1)	Controls the output level of the IG-115 throughout a 10 dBμV/MHz range in 1 dB steps.
3	PUSH ON/OFF	Illuminated push-push switch, red lens (S5)	Energizes the Model IG-115 Impulse Generator
4	PULSE POLARITY + -	2 position toggle switch (S3)	Provides polarity reversibility to select positive or negative output pulses

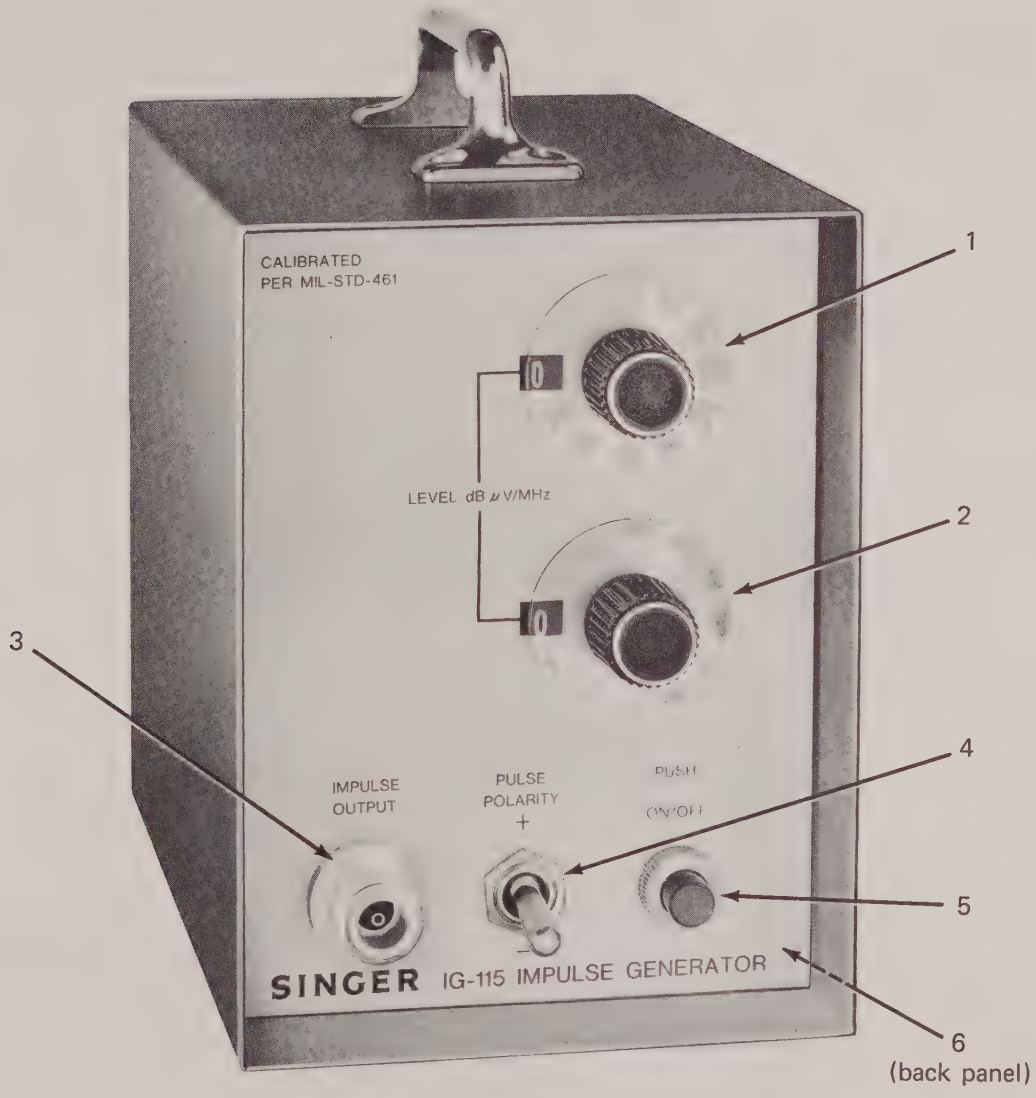


Figure 4-1. Controls, Indicators, and Receptacles, Model IG-115

Table 4-1. Controls, Indicators and Receptacles, Continued

Item	Panel Marking	Description	Function
5	IMPULSE OUTPUT	Type N receptacle (J1)	Provides signal output
6	FUSE (back panel)	Fuseholder (XF1)	Provides access to ac fuse. (1/2 A for 115 V, 1/4 A for 230 V).

4.3 GENERAL OPERATING INSTRUCTIONS

a. Place the Model IG-115 on a bench or other horizontal flat surface so that the carrying handle is on top. The instrument will not function satisfactorily if the equipment is tilted greater than 30° from the vertical axis because of mercury switch contact flooding.

b. Connect the power cord to a 115 V, 50 Hz or 60 Hz power source. For 230 V power source operation, see Paragraph 3.2.2.

c. Connect the IMPULSE OUTPUT receptacle of the Model IG-115 Impulse Generator to the 50 ohm receiver or measuring instrument RF input receptacle using the RF Cable Model 90933-6 or equivalent.

> CAUTION
>
> The IMPULSE OUTPUT receptacle of the Model IG-115 Impulse Generator must be connected to a 50 ohm load that has a dc path to ground. In the absence of a dc path use Attenuator Pad Model 90530-10 or equivalent at the output of the Model IG-115. (Refer to Paragraph 4.6.1 for details.)

d. Set the PULSE POLARITY switch to + or - position.

e. Set the two attenuator switches to the desired output level in terms of dB above one microvolt per megahertz (dBμV/MHz).

f. Depress the ON/OFF switch to the ON position. The red lamp should light and a low buzzing noise should be heard.

4.4 BANDWIDTH MEASUREMENTS

The impulse bandwidth of a receiver or amplifier can be measured at any frequency from 100 kHz to 1 GHz by comparing the sine wave sensitivity of the receiver with its impulse sensitivity. Since the Model IG-115 produces a flat (±1 dB) spectral output from 100 kHz to 1 GHz, any change in the impulse sensitivity not accompanied by a proportional change in sine wave sensitivity is an indication of a change in bandwidth.

The following procedure can be used for determining the impulse bandwidth of any receiver or amplifier equipped with a Peak Slideback detector.

a. Set the output level of the impulse generator to some convenient level well above the output display level of the internal noise of the equipment under test. Convert the output level of the Impulse Generator to μV/MHz by the following:

$$\mu V/MHz = \log_{10}^{-1} \frac{(dB\mu V/MHz)}{20}$$

NOTE:
Observe instrument test overload precautions. (See Paragraphs 4.6.1 and 4.6.2.)

b. Without changing any equipment controls, substitute a sine wave (CW) generator with calibrated output level for the Impulse Generator.

NOTE

The CW generator must have a 50 ohm output impedance and both generators must use the same 50 ohm load. At higher frequencies the same 50 ohm RF cable should be used to ensure that cable losses will be identical.

Tune the CW generator to the center frequency of the equipment under test. Adjust the CW generator output level (no modulation) for the same signal output display level used in Step a. Note and record the CW generator output level in microvolts.

c. The impulse bandwidth of the equipment under test can then be found by dividing the sine wave generator output level in microvolts by the Impulse Generator output level in microvolts-per-megahertz. (Refer to Paragraph 4.6.4 for explanation of impulse bandwidth.) Example: IG level = 40 dBμV/MHz = 100 μV/MHz, CW gen level = 1 μV, BW = $\frac{1}{100}$ = 0.01 MHz = 10 kHz.

4.5 IMPULSE INTERFERENCE MEASUREMENTS

For EMI/FI Meters not equipped with an internal impulse generator, and having a Peak Slideback detector, an external generator such as the Model IG-115 is extremely useful in the measurement of impulse interference. Its use permits the measurement of impulse signals directly in terms of dB above on microvolt-per-megahertz without involving bandwidth computations. (Refer to Paragraph 4.6.3 for explanation of impulse signal.)

4.5.1 Measuring Impulse Signal Levels Below 100 dBμV/MHz

The following procedure may be used for measuring signal levels that do not exceed 100 dBμV/MHz. (This is the maximum output of the Model IG-115.)

a. Perform a Peak Slideback or Direct Peak detector measurement of the unknown broadband signal with the EMI/FI Meter. It is not necessary to standardize the gain of the EMI/FI equipment but it is advisable to operate with the lowest attenuator step and the highest receiver gain that is practical. (See Paragraph 4.6.2 regarding overload precautions.)

b. Without disturbing the EMI/FI Meter controls, substitute the Impulse Generator signal for the unknown signal. Adjust the Impulse Generator output level for the same Peak indication noted in Step a.

c. For direct 50 ohm conductive measurements, the unknown signal level is equal to the output level of the Impulse Generator. The output level can be read directly from the attenuator controls and is in terms of dB above one microvolt-per-megahertz bandwidth.

d. For conductive measurements using a current probe, algebraically subtract the current probe transfer impedance in dB from the final reading of Step c to obtain the value of the RF current in terms of dB above one microampere-per-megahertz.

e. When measuring radiated impulse interference with a pick-up device, such as an antenna, add the antenna correction factor in dB to the final reading of Step c to obtain the value of field intensity in dB above one microvolt-per-meter-per-megahertz bandwidth (dBμV/m/MHz). It is advisable to use the same cable between signal source and EMI/FI Meter as is used between Impulse Generator and EMI/FI Meter to eliminate the error due to cable losses.

4.5.2 Measuring Impulse Signal Levels Above 100 dBμV/MHz

The maximum output of the Model IG-115 Impulse Generator is 100 dBμV/MHz. When the unknown signal exceeds this level, the following measurement procedure is recommended.

a. Perform a Peak Slideback or Direct Peak detector measurement of the unknown broadband signal with the EMI/FI Meter. It is not necessary to standardize the gain of the EMI/FI equipment but it is adviseable to operate with the lowest attenuator step and the highest receiver gain that is practical. (See Paragraph 4.6.2 regarding overload precautions.)

b. Substitute the Impulse Generator signal for the unknown signal and adjust its output level to 100 dBμV/MHz.

c. Adjust the EMI/FI Meter attenuator only as required for an on-scale meter indication and take measurement.

d. Subtract the EMI/FI Meter indication (output meter scale reading in dB plus the attenuator position in dB) of the Impulse Generator output in Step c from the EMI/FI Meter indication of the unknown signal in Step a. This difference in dB, plus 100 dB, is the signal level in dBμV/MHz.

e. When measuring radiated impulse interference with a pick-up device, such as an antenna, add the antenna correction factor in dB to the final indication of Step d to obtain the peak value of field intensity in dBμV/m/MHz. It is advisable to use the same cable between the Impulse Generator and EMI/FI Meter as between the unknown signal source and EMI/FI Meter to eliminate the error due to cable losses.

4.6 OPERATING CONSIDERATIONS

The Model IG-115 Impulse Generator is often used as a reference for the measurement of broadband signals and impulse bandwidth. These measurements can be performed only when the Model IG-115 is used in conjunction with a suitable receiver or electromagnetic interference and field intensity (EMI/FI) measuring instrument. The following paragraphs describe some of the characteristics of these measurements and the relationship of the equipments used.

4.6.1 Load Considerations

Observe the following precautions when connecting the Model IG-115 to a load:

a. A resistive 50 ohm load was used during calibration of the Model IG-115 impulse output level. Therefore, for accurate output level the load should be 50 ohms and have low VSWR.

b. The load must provide a dc path to ground. Depending upon pulse polarity, the action of the impulse generator line is to transfer electrons to or away from the output circuit. Unless there is a dc path to ground, a back-EMF will build up and effectively reduce the impulse generator output level.

c. The load must be capable of withstanding approximately 280 V peak pulse if the maximum output level of the Model IG-115 is used.

4.6.2 Receiver Requirements

A suitable receiver shall have a 50 ohm input impedance and low input VSWR. Some means of signal output display must be available, e. g. output meter or IF output or video output with oscilloscope display. The receiver should not be easily overloaded by strong signals. Most EMI/FI instruments have all the required features.

When operating with an impulse signal, care should be taken to prevent receiver overload. This is easily detected by noting the receiver output indication obtained by changing the Impulse Generator PULSE POLARITY switch from positive to negative. The generator output level does not change with polarity; therefore any change in receiver output level is caused by receiver overload. Since most receivers have an RF, IF or audio gain control, the input stage may be receiving a strong signal although the receiver output level may be low. Therefore it is good practice to keep the receiver gain high and the Impulse Generator output level low.

4.6.3 Impulse Signal

A pulse is considered 'impulsive' when its duration is short relative to the period of the maximum frequency to be considered; e.g. 0.5 ns compared to 1 ns (1 GHz). Also, the pulse width must be very much less than the reciprocal of the bandwidth of the detecting instrument. Stated differently, a pulse is considered impulsive when the overall rise time of the detecting instrument is long compared to the pulse duration. The generator output is not considered impulsive when the detecting instrument rise time approaches the pulse duration. For example, with the pulse duration of the Model IG-115 of 0.5 picoseconds, and a bandpass circuit of the same rise time, the equivalent bandwidth would be approximately

$$B = \frac{0.7}{T} = \frac{0.7}{0.0005} = 1400 \text{ megahertz}$$

where: B = 3 dB bandwidth in megahertz

T = Rise time of bandpass circuit in microseconds

For all normal applications, the output of the Model IG-115 generator can be considered impulsive. For the practical detecting or receiving instrument used below 1000 megahertz and subjected to an impulsive signal input, the output will be inversely proportional to rise time and directly proportional to the impulse bandwidth.

4.6.4 Impulse Bandwidth

The impulse bandwidth may be derived with the aid of an oscilloscope as follows:

> Divide the peak value of the receiver or amplifier impulse response envelope by the area; this provides an equivalent rectangular response. The reciprocal of the rectangular response width in seconds (derived from the sweep speed) is the impulse bandwidth in Hertz.
>
> Refer to the typical impulse response envelope displayed in Figure 4-2. The width of the equivalent rectangular response is 2.5 μs. The impulse bandwidth is:

$$BW_{imp} = \frac{1}{Tr\ Secs} = \frac{1}{2.5 \times 10^{-6}} = 0.4 \times 10^{6}\ Hz = 400\ kHz$$

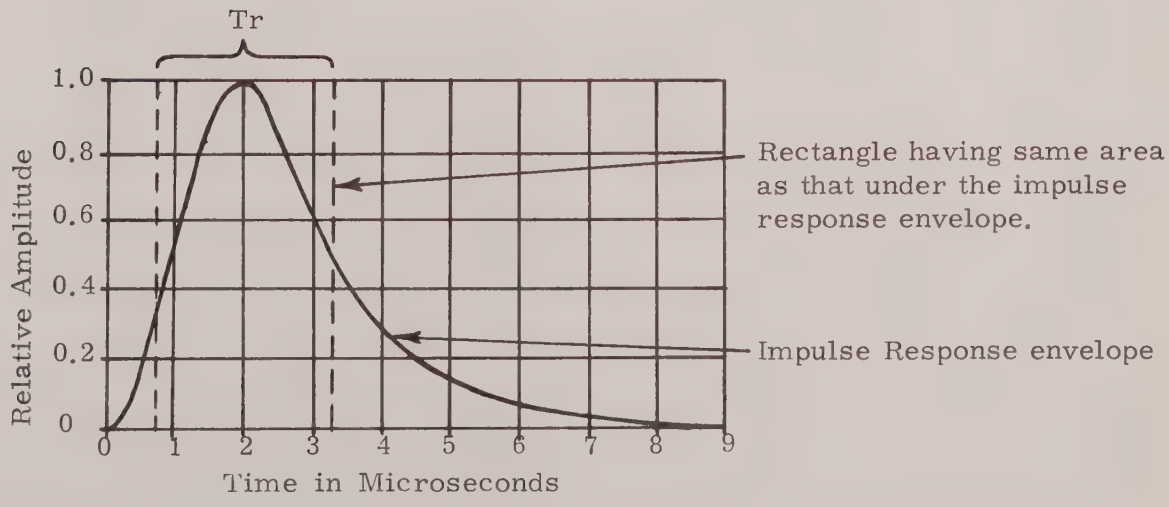


Figure 4-2. Typical Impulse Response Envelope

Section V

THEORY OF OPERATION

5.1 INTRODUCTION

This section contains the theory of operation of the Model IG-115. The information is presented to assist the user in understanding the circuitry employed and is useful in troubleshooting and maintenance of the equipment.

5.2 GENERAL

The Model IG-115 UHF Impulse Generator produces electrical pulses which are so short in duration as to have a frequency spectrum that is essentially flat from 100 kilohertz to 1.0 gigahertz. The principle used in this equipment for the production of short pulses consists of charging and discharging a short coaxial transmission line having a $\frac{\lambda}{4}$ resonant frequency of approximately 2.0 gigahertz. The pulse amplitude and the RF power output level can be varied by changing the level of the dc charging potential.

5.3 CIRCUIT ANALYSIS

The instrument consists basically of a regulated power supply, a polarity-reversing switch, two step attenuators, and an impulse generator. The following operating analysis is referenced to the schematic diagram, Figure 8-1, and to the detailed block diagram, Figure 5-4.

5.3.1 Power Supply Circuitry

The self-contained power supply is designed to operate from a single-phase source, 105 V to 130 V or 210 V to 260 V, 50 Hz to 60 Hz. The input power for the line charging voltage is obtained from the secondary winding of the transformer, T1,

and is rectified by silicon rectifier bridge, CR1. The full-wave rectified output is filtered by capacitor, C1, and series dropping resistor, R1. Voltage regulation and additional filtering is achieved by dropping resistor, R2, and four gaseous regulator tubes, V1 through V4, in series to provide an approximate output voltage of 550 Vdc.

5.3.2 Polarity Reversing Circuitry

The polarity of the output pulse can be changed by reversing the polarity of the charging voltage to S1 and S2 and to the Impulse Generator, S4. The PULSE POLARITY switch, S3, provides this control by reversing the connections of ground and voltage output across the regulator string V1, V2, V3, and V4.

5.3.3 Attenuator Circuitry

The pulse amplitude and RF power output is determined by the dc charging potential. This charging level is controlled by two attenuator switches, S1 and S2. S1 is an eleven-position step attenuator which can vary the output level in 1 dB steps throughout a 10 dB range. S2 is also an eleven-position step attenuator which can vary the output level in 10 dB steps throughout a 90 dB range. Between the 0 dB and 90 dB position, there is a position which opens the charging circuit and disables the output of the Model IG-115.

The individual resistors included in the S1, S2 voltage divider arrangement are accurate to within one percent. This ensures excellent overall attenuator accuracy. Therefore the step attenuator switches are designed so that the impulse generator

output can be varied from 0 to 100 dB above 1 microvolt-per-megahertz in 1 dB steps.

5.3.4 Impulse Generator Circuitry, S4

The impulse generator, S4, consists of a short coaxial line in series with a mercury switch. See Figure 5-1.

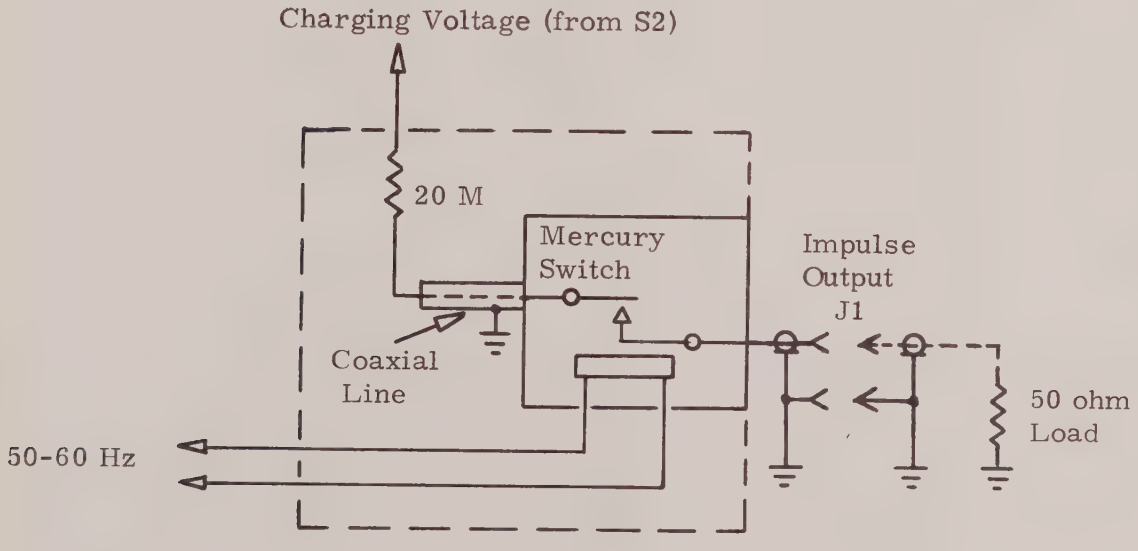


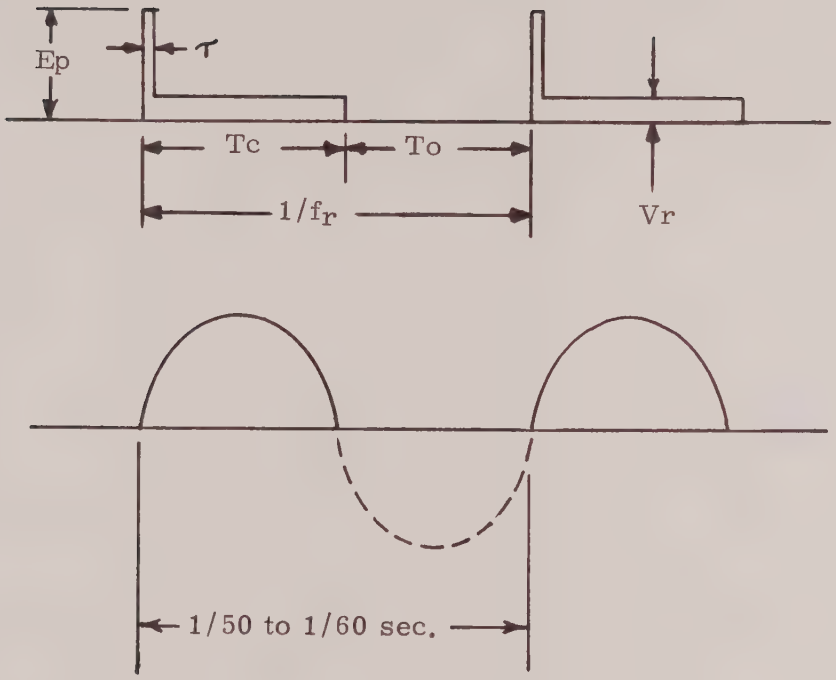
Figure 5-1. Details of Impulse Generator, S4

The outer conductor of the coaxial line is at ground potential and one end of the internal conductor is connected to a calibrated dc voltage source through a high resistance. The mercury switch is connected in series with the other end of the inner conductor and the 50 ohm load. The "charged" coaxial line is discharged periodically into the output circuit by the mercury switch in the following manner: The mercury switch contacts are operated by a pulsating magnetic field generated by a coil that surrounds the line. The coil is periodically energized at the power line frequency from a power transformer secondary winding using a half-wave rectifier. In this manner the charged coaxial line is discharged at the power source frequency rate (50 Hz to 60 Hz) which determines the pulse repetition rate. The discharging time through the mercury contacts is very small compared to the charging time when the contacts are open. Also, during the short discharge time, the input to the coaxial line is effectively an open circuit because of the high charging resistance of 20 megohms. However, the recharging time is quite short because of the relatively small capacitance of the coaxial line. The width of the generated rectangular pulse is equal to twice the delay of the coaxial line and therefore its duration is determined by the length of the line.

5.4 IMPULSE GENERATOR FUNDAMENTALS

An Impulse Generator is an instrument capable of generating rectangular pulses that may be many volts in amplitude for very short durations. Such short duration pulses have a constant spectral intensity over a very wide frequency range.

The output of the Model IG-115 Impulse Generator is displayed in the time domain in Figure 5-2.



Generator Output Pulse

Power Line Frequency (Pulsating dc drives mercury switch)

τ = Pulse width of impulse (determined by length of coaxial line- approximately 0. 5 nanoseconds for the Model IG-115 Impulse Generator)

f_r = Pulse repetition rate (determined by power source frequency)

$1/f_r$ = Time interval between pulses (approximately 16 ms)

Ep = Peak pulse amplitude (controlled by dc charging potential from S1 and S2)

Vr = Residual voltage level of pulse after line discharge but before the mercury switch contacts open.

Tc = Duration of contact closure (approximately 8 ms)

To = Duration of contact opening (approximately 8 ms)

Figure 5-2. Impulse Generator Waveforms in Time Domain

The output of the IG-115 Impulse Generator is displayed in the frequency domain in Figure 5-3.

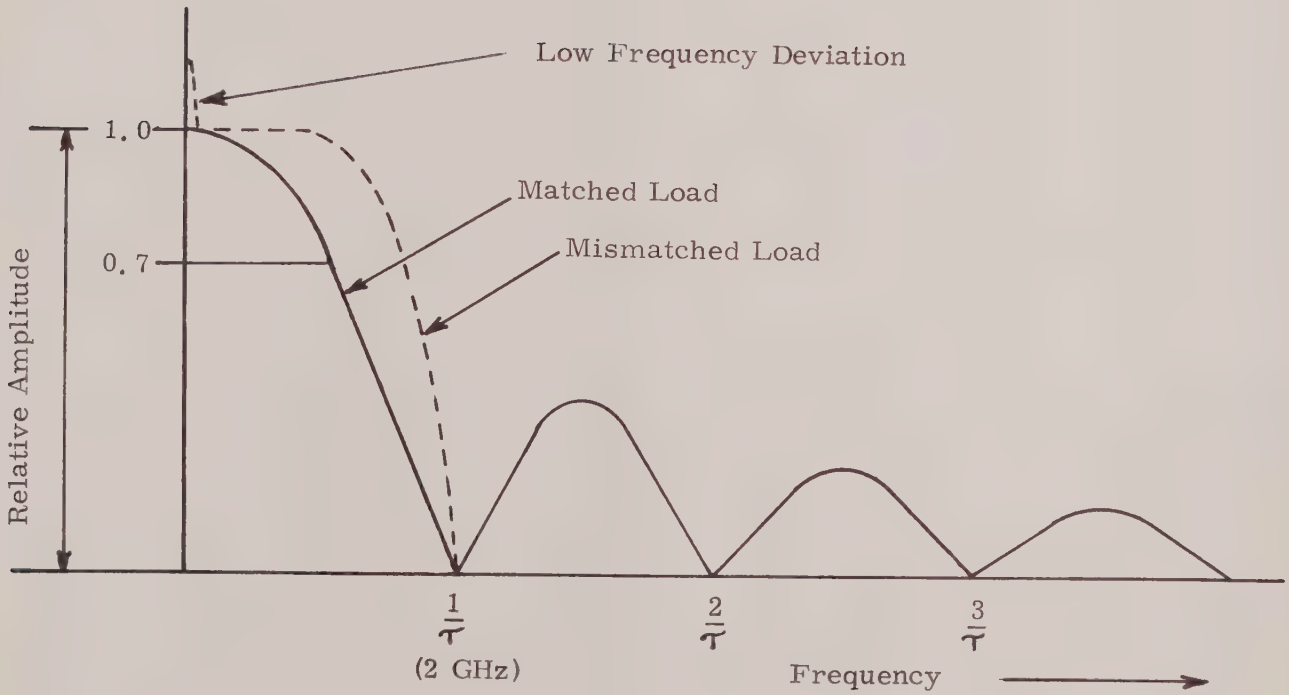


Figure 5-3. Impulse Generator Output in Frequency Domain

The spectral intensity of a rectangular pulse is given by the $\frac{\sin X}{X}$ function. As the duration of the pulse decreases, the width of the first lobe of the $\frac{\sin X}{X}$ function increases. The amplitude spectrum of a rectangular pulse is:

$$A_{(F)} = \frac{\text{Sin } n \pi \tau \quad F}{n \pi \tau \quad F}$$

where: $A_{(F)}$ = Amplitude at computed frequency

τ = Pulse duration in seconds

F = Frequency in hertz

n = 1

The amplitude values at representative frequency points of the theoretical (matched load) Model IG-115 Impulse Generator curve can be calculated and are displayed in Table 5-1.

Table 5-1. Frequency Versus Amplitude of an Impulse

Frequency	Radians	Relative Amplitude	% of Max	dB Down (Approx)
333 MHz	$\pi/6$	0.955	95.5	0.5
500 MHz	$\pi/4$	0.901	90.1	1.0
667 MHz	$\pi/3$	0.827	82.7	1.5
1.0 GHz	$\pi/2$	0.636	63.6	4.0
1.333 GHz	$2\pi/3$	0.411	41.1	7.0
1.5 GHz	$3\pi/4$	0.300	30.0	10.0
2.0 GHz		0	Null Point	

Using the above data, the flatness of the impulse can be calculated. For example, at 500 MHz the amplitude is down approximately 1 dB. Furthermore, the impulse is flat to 1 GHz (within 4 dB).

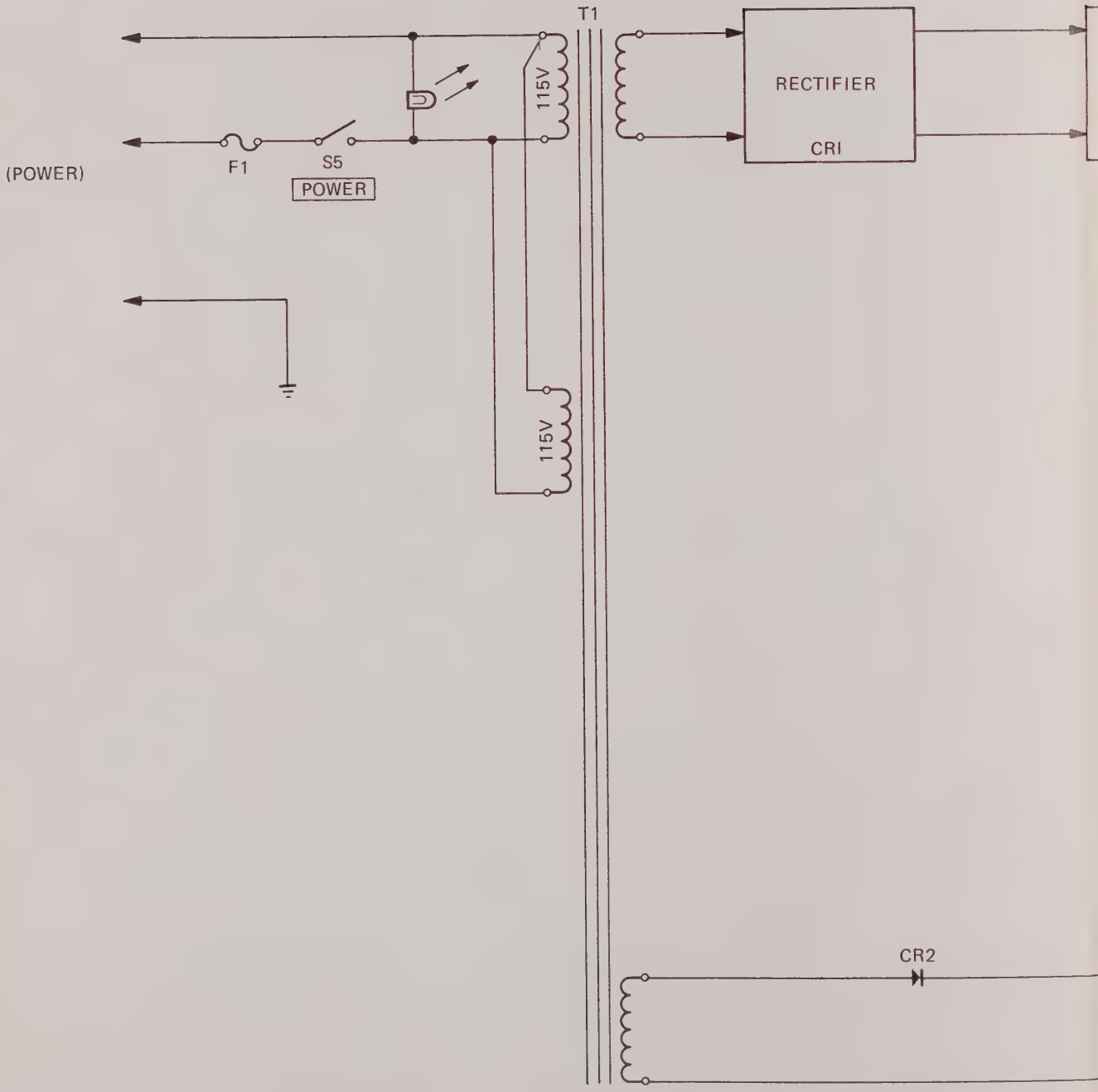
However, the spectral flatness of the Model IG-115 has been extended higher in frequency, (see the mismatched load dotted curve of Figure 5-3) by creating a mismatch between the transmission line impedance and the load impedance. The optimum mismatch occurs when $Z_{load}/Z_{line} = 0.74$. Since Z_{load} is known to be 50 ohms, Z_{line} has been made 50/0.74, or approximately 67 ohms. The guaranteed spectral flatness of the Model IG-115 is within ±1 dB up to 1 GHz.

Below 100 kHz, however, the error exceeds ±1 dB. (See the low frequency deviation dotted curve of Figure 5-3.) The coaxial line is discharged when the mercury switch is closed, which generates a pulse. The pulse voltage does not immediately return to zero after the coaxial line is discharged, as displayed in Figure 5-2. When the mercury switch is closed, a voltage divider is formed, consisting of the 20 megohm charging resistor and the 50 ohm Impulse Generator output load through which the discharge is made. The impulse output level will remain slightly above zero volts until the mercury switch contacts open at the end of the period, T_C. This creates a broad, low amplitude pulse to affect the low frequency end of the frequency spectrum amplitude.

5.5 CALIBRATION TERMS

The Model IG-115 output is calibrated in terms of dB above one microvolt per megahertz (dBμV/MHz). This is the rms spectral intensity and is in the same broadband terms used for EMI measurements. MIL-STD-463 defines impulse strength as:

> "The rms unmodulated sine wave voltage required to produce in a circuit a peak response equal to that produced by the impulse in question, divided by the impulse bandwidth of the circuit."


T1
115V
RECTIFIER
CR1
(POWER)
F1
S5
POWER
115V
CR2

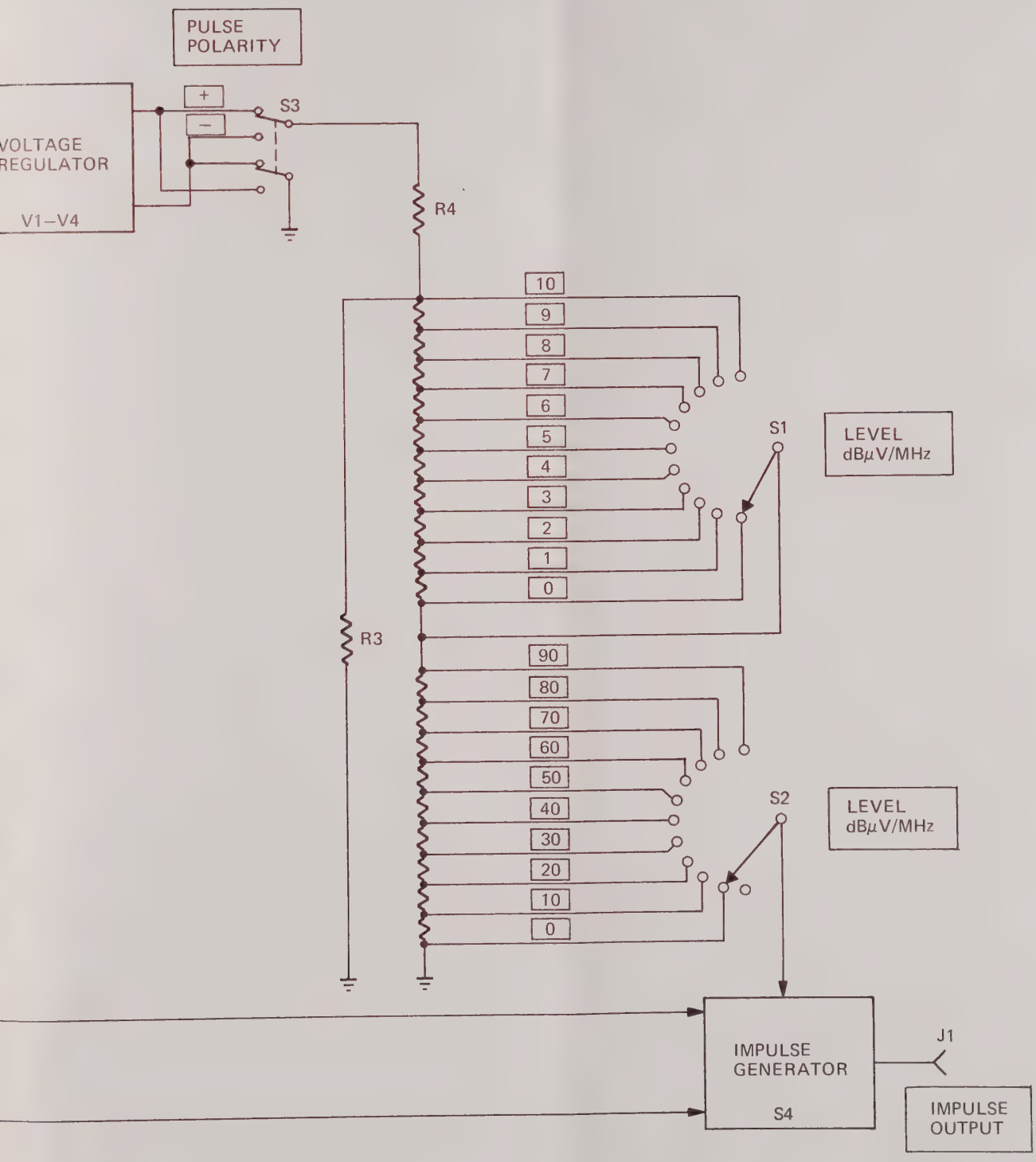


Figure 5-4. Detailed Block Diagram, Model IG-115

Section VI

MAINTENANCE

6.1 INTRODUCTION

This section contains information for the maintenance of the Model IG-115. Included are minimum performance checks, alignment procedures, and fault isolation procedures.

6.2 MINIMUM PERFORMANCE CHECKOUT AND ADJUSTMENT

Verification of the output level accuracy constitutes the Minimum Performance Checkout procedure. Due to the involved calibration procedure, it is recommended that the instrument be returned to the factory for necessary calibration. If this is not convenient, refer to MIL-STD-462, "Electro Magnetic Interference Characteristics, Measurements of," Paragraph 4.2.3.6, Impulse Generators.

6.3 DISASSEMBLY PROCEDURES

a. Remove the two 6-32 x 3/8" Phili ps-head screws from the back of the instrument.

b. Remove the 6-32 x 3/8" Philips-head screw from the bottom of the instrument.

c. Slide the instrument out of the case.

> WARNING
>
> 550 volts is developed by the power supply and, depending on the attenuator settings, 550 volts can be applied to the top of mercury switch assembly, S4.

6.4 ALIGNMENT AND ADJUSTMENT

When calibrating the output level (spectral intensity) of the Model IG-115 Impulse Generator in accordance with MIL-STD-462, Paragraph 4.2.3.6, perform the calibration as given and select the value of resistor, R4, to produce the desired output level accuracy.

6.5 FAULT ISOLATION PROCEDURE

> **WARNING**
>
> The impulse generator switch, S4, in the Model IG-115 utilizes a glass cartridge containing mercury under pressure, and no attempt should be made to open it.

If no output pulse is obtained, check the following with the attenuator dials adjusted for maximum output level and the PULSE POLARITY switch set to the + position.

a. Examine the fuse. Replace with a new fuse if necessary.

b. Check voltage at the charging line (top of impulse generator, S4.) It should be 450 V ±100 Vdc (+350 Vdc to +550 Vdc), depending upon the selected value of resistor, R4. If no voltage appears, check the voltage regulator tubes or the rectifier bridge, CR1.

c. A faint buzzing sound should be heard in the impulse generator, S4. If this sound is not heard, check the coil driving voltage with an oscilloscope. This should be approximately 5 V pulsating dc.

Section VII

REPLACEABLE PARTS

7.1 INTRODUCTION

This section contains information for ordering replacement parts. Table 7-1 lists the parts of the Model IG-115. Parts are listed in the alpha-numerical order of their reference designators and indicate the description, the Singer part number, typical manufacturer of the part in a five-digit code, and the Manufacturer's part number. Table 7-2 lists the typical manufacturers in numerical code number order.

Table 7-1. Model IG-115 Parts List

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
C1	Capacitor, fixed, mylar, 1.0 μF, ±20%, 1000 Vdc	1-900125-001	0000A	D10-105
CR1	Rectifier, bridge	1-913079-001	04713	MDA-922-9
CR2	Diode, silicon	1-913001-001	04713	1N4001
F1	Fuse, normal-blo, 1/2 amp, 25 V	1-924005-013	75915	3AG-1/2
R1	Resistor, fixed, composition, 330 ohm, ±5%, 2 W	1-945003-150	01121	HB3315
R2	Resistor, fixed, wire wound, 3 kilohm, ±5%, 3 W	1-945064-002	91637	Type RS-2
R3	Resistor, fixed, composition, 360 kilohm, ±5%, 2 W (2 required)	1-945003-223	01121	HB3645
R4	Resistor, fixed, composition, selected, 68 kilohm nominal, ±5%, 1 W	1-945002-206	91121	GB6835
R5	Resistor, fixed, film, 31.6 ohm, ±1%, 1/2 W	S10935-31R6	11350	Type FCA15
R6	Resistor, fixed, film, 68.4 ohm, ±1%, 1/2 W	S10935-27	11350	Type FCA15
R7	Resistor, fixed, film, 216 ohm, ±1%, 1/2 W	S10935-2	11350	Type FCA15
R8	Resistor, fixed, film, 684 ohm, ±1%, 1/2 W	S10935-3	11350	Type FCA15
R9	Resistor, fixed, film, 2.16 kilohm, ±1%, 1/2 W	S10935-8	11350	Type FCA15
R10	Resistor, fixed, film, 6.84 kilohm, ±1%, 1/2 W	S10935-9	11350	Type FCA15

Table 7-1. Model IG-115 Parts List (Continued)

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
R11	Resistor, fixed, film, 21.6 kilohm, ±1%, 1/2 W	S10935-10	11350	Type FCA15
R12	Resistor, fixed, film, 68.4 kilohm, ±1%, 1/2 W	S10935-11	11350	Type FCA15
R13	Resistor, fixed, film, 216 kilohm, ±1%, 1/2 W	S10935-17	11350	Type FCA15
R14	Resistor, fixed, film, 684 kilohm, ±1%, 1/2 W	S10935-23	11350	Type FCA15
R15	Resistor, fixed, film, 123 kilohm, ±1%, 1/2 W	S10935-12	11350	Type FCA15
R16	Resistor, fixed, film, 137 kilohm, ±1%, 1/2 W	S10935-13	11350	Type FCA15
R17	Resistor, fixed, film, 154 kilohm, ±1%, 1/2 W	S10935-14	11350	Type FCA15
R18	Resistor, fixed, film, 169 kilohm, ±1%, 1/2 W	S10935-15	11350	Type FCA15
R19	Resistor, fixed, film, 196 kilohm, ±1%, 1/2 W	S10935-16	11350	Type FCA15
R20	Resistor, fixed, film, 218 kilohm, ±1%, 1/2 W	S10935-18	11350	Type FCA15
R21	Resistor, fixed, film, 243 kilohm, ±1%, 1/2 W	S10935-19	11350	Type FCA15
R22	Resistor, fixed, film, 272 kil0 ohm, ±1%, 1/2 W	S10935-20	11350	Type FCA15
R23	Resistor, fixed, film, 308 kilohm, ±1%, 1/2 W	S10935-21	11350	Type FCA15
R24	Resistor, fixed, film, 340 kilohm, ±1%, 1/2 W	S10935-22	11350	Type FCA15

Table 7-1. Model IG-115 Parts List (Continued)

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
R25	Resistor, fixed, composition, 33 kilohm, ±5%, 1/2 W	1-945001-198	01121	EB3335
S1	Switch, rotary, 1 pole, 11 positions	002779-001	76854	2779D
S2	Switch, rotary, 1 pole, 11 positions	002779-001	76854	2779D
S3	Switch, toggle, DPDT	556019-291	82496	ST52N
S4	Impulse Generator	1-003901-001	88869	
S5	Switch, push-push, illuminated, red lens, SPDT	1-951033-001	26012	616-6-1-A1
T1	Transformer, power, 115/230 V rms, primary	009120-001	73386	35283
V1	Electron tube, voltage regulator	1-917009-001	49671	OA2
V2	Electron tube, voltage regulator	1-917009-001	49671	OA2
V3	Electron tube, voltage regulator	1-917009-001	49671	OA2
V4	Electron tube, voltage regulator	1-917009-002	49671	OB2
XF1	Fuseholder, for 3 AG fuses	1-924003-002	75915	341001
	Instruction Manual	1-500783-182	88869	

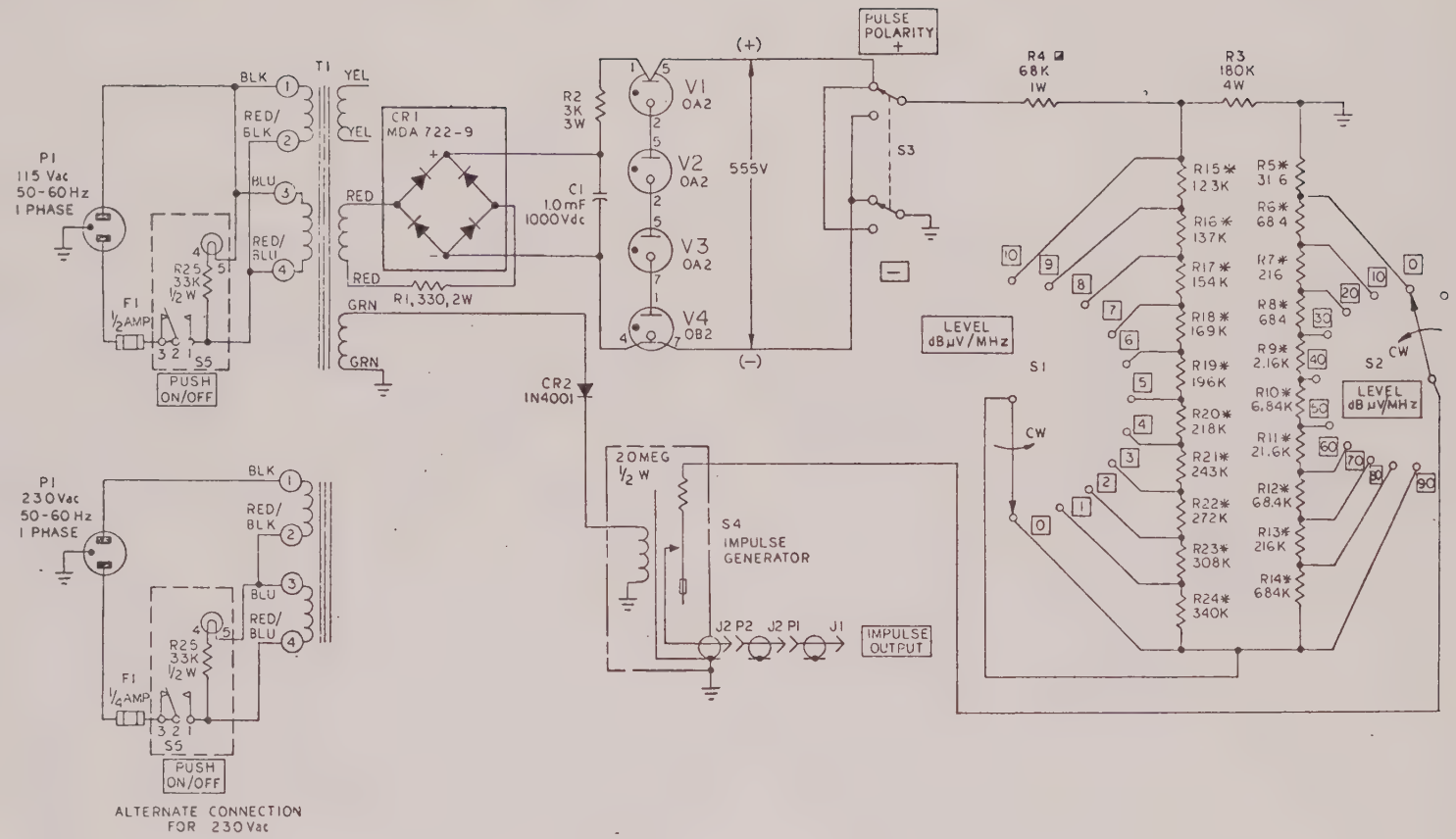
Table 7-2. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-1.

Table 7-2. Code List of Manufacturers, (Continued)

Code No.	Manufacturer	Address
01121	Allen-Bradley Co.	Milwaukee, Wisc.
04713	Motorola Inc.	Phoenix, Ariz.
11350	Penn Resistor Corp.	Lansdale, Pa.
26012	Marco Electric Co.	Womelsdorf, Pa.
49671	RCA	New York, N. Y.
73386	Freed Transformer Co.	Brooklyn, N. Y.
75915	Littelfuse Inc.	Des Plaines, Ill.
76854	Oak Mfg. Co.	Crystal Lake, Ill.
82496	Electro Switch & Controls Co.	Los Angeles, Calif.
88869	Singer Instrumentation	Los Angeles, Calif.
91637	Dale Electronics Inc.	Columbus, Neb.
0000A*	ITT Jennings	Monrovia, Calif.

*This vendor has no listing in the latest supplement to the Federal Supply Code for Manufacturers Cataloging Handbook H4-1.



4. ▭ BOXED IN CHARACTERS INDICATE FRONT PANEL MARKINGS.
3. ◪ INDICATES FACTORY ADJUSTED RESISTORS, VALUES SHOWN ARE NOMINAL.
2. * INDICATES 1% RESISTORS ¼ W.
1. ALL RESISTANCES ARE IN OHMS.

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 8-1 - Schematic Diagram,
UHF Impulse Noise Generator, Model IG-115
For use with serial numbers 126 and above.

Dwg. No. 3-501340-001 Rev. A

Appendix A

BACKDATING INFORMATION
FOR
THE MODEL IG-115

Singer's Los Angeles Instrumentation Operation
Serial Numbers 101 thru 125

Singer's Los Angeles Instrumentation Operation Serial Numbers 101 thru 125 had a decal bearing a correction factor of approximately -2 dB. This was necessitated by insufficient charging voltage.

Page 7-2/7-3, Parts List.

The parts list is the same with the following exceptions:

Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Part No.
C1	Capacitor, fixed, paper, 0.5 μF, ±10%, 1000 Vdc	556074-072	00853	CP65B1 EG504K
CR1	Diode, metallic (3 required)	556118-087	77638	1641
CR2	Diode, rectifier	556118-083	77638	IPI
DS1	Lamp, No. 47	556002-006	88695	No. 47
R2	Resistor, fixed, wire wound, 4.7 kilohm, ±5%, 2 W	1511005472J	01121	HB4725
R3	Resistor, fixed, composition, selected, 360 kilohm nominal, ±5%, 2W (2 required)	1-945003-223	01121	HB3645
R4	Resistor, fixed, composition, selected, 24 kilohm nominal, ±5%, 1/2 W	1511005243J	01121	CB2435
R25	Not used			

Page 7-2/7-3, Parts List (Continued)

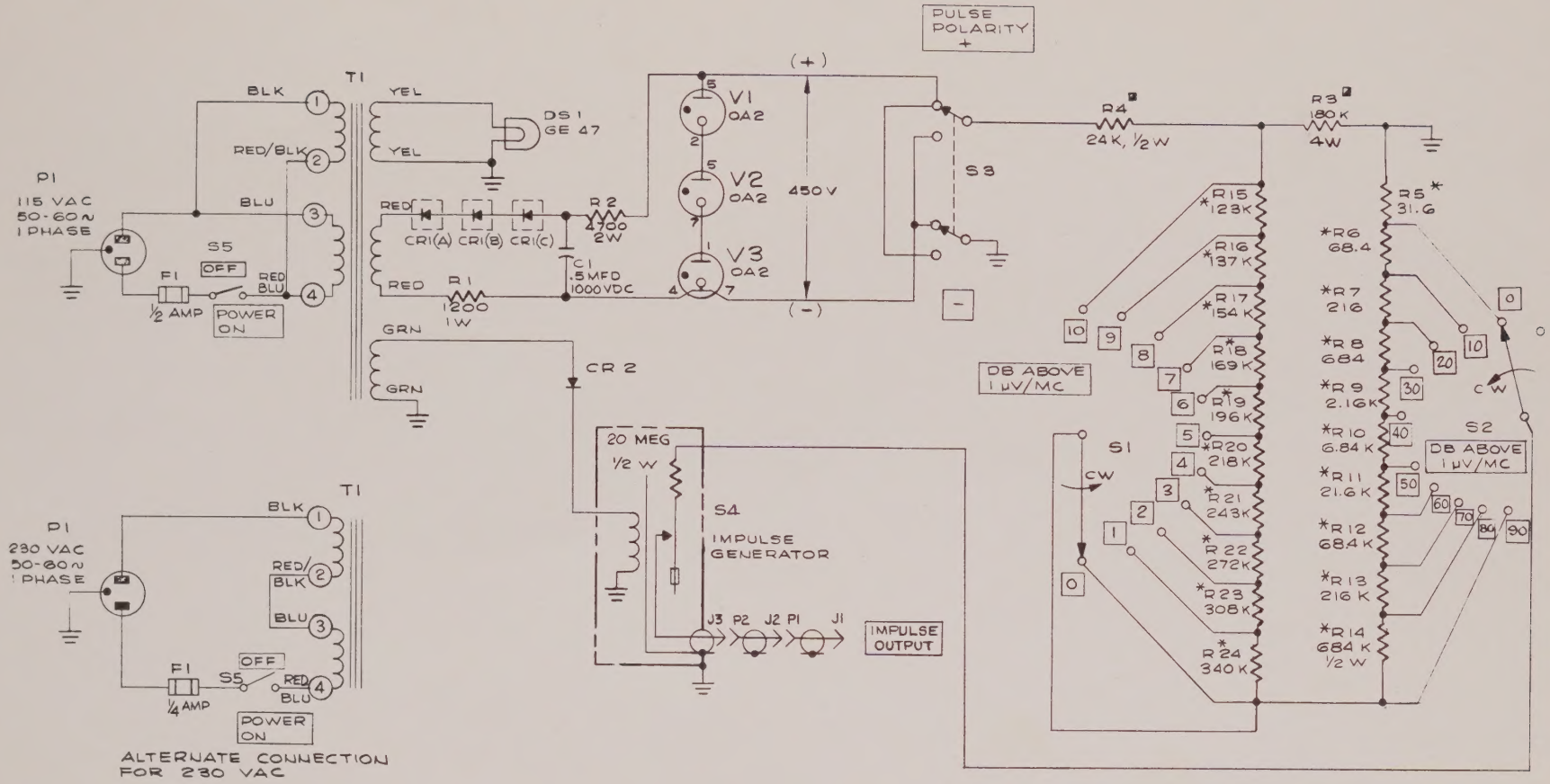
Ref. Desig.	Description	Singer Part No.	Mfr. Code No.	Mfr. Code No.
S4	Impulse Generator	002793-001	88869	
S5	Switch, toggle, SPST	556019-289	31356	ST42A
V4	Not used			

Page 7-4, Add the following information:

Code No.	Manufacturer	Address
31356	JBT Instruments, Inc.	New Haven, Conn.
77638	Radio Receptor Co., Inc.	Brooklyn, N. Y.
88695	Radio Products Co.	Chicago, Ill.

Page 8-1, Figure 8-1. Schematic Diagram, UHF Impulse Noise Generator, for use with serial number 126 and above.

Replace with attached schematic diagram, Figure A-1, for use with serial numbers 101 thru 125.



4- ☐ BOXED IN CHARACTERS INDICATE FRONT PANEL MARKINGS

3- ◪ INDICATES FACTORY ADJUSTED RESISTORS WHICH MAY BE OMITTED, VALUES SHOWN ARE NOMINAL

2- * INDICATES 1% RESISTORS, ⅛ W

ALL RESISTANCES ARE IN OHMS

Figure A-1. Schematic Diagram, UHF Impulse Noise Generator for use with serial numbers 101 thru 125.

Dwg. No. 004321-07

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